High-Risk Individuals' Willingness to Pay for Diabetes Risk-Reduction Programs

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OBJECTIVE — The purpose of this study was to estimate how much at-risk individuals are willing to pay for type 2 diabetes primary prevention programs.

RESEARCH DESIGN AND METHODS — An Internet-based, choice-format conjoint survey was presented to individuals at elevated risk for type 2 diabetes. Hypothetical diabetes risk-reduction programs included seven features: diet, exercise, counseling, medication, weight loss goal, risk reduction, and program costs. The sample included 582 individuals aged ≥45 years, two-thirds of whom were obese. Conditional logit models were used to calculate participants' willingness to pay for risk reduction programs. Each respondent's self-assessed risk of developing diabetes was compared with an objective measure based on a diabetes screening tool.

RESULTS — Many respondents underestimated their personal risk of developing diabetes. Those with a low perceived risk were less likely to indicate that they would participate in a diabetes prevention program. Individuals had the strongest preference for programs with large weight loss goals, fewer restrictions on diet, and larger reductions in the risk of diabetes. Respondents were willing to pay ~$1,500 over 3 years to participate in a lifestyle intervention program similar to the Diabetes Prevention Program. Individuals with a high perceived risk were willing to pay more than individuals with lower perceived risk.

CONCLUSIONS — Many individuals will be willing to participate in interventions to delay or prevent diabetes if the interventions are subsidized, but most will be unwilling to pay the full program cost. Our results also offer insights for designing risk-reduction programs that appeal to potential participants.

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Several recent studies have demonstrated that type 2 diabetes can be prevented or delayed by lifestyle modification (e.g., controlling diet, losing weight, and exercising) in at-risk individuals (1–4). In the U.S., the Diabetes Prevention Program (DPP) conducted a randomized clinical trial involving 3,234 individuals at high risk of developing diabetes that compared lifestyle and metformin interventions with a placebo intervention (3). Those receiving the lifestyle intervention had a 58% reduction in the incidence rate of diabetes (median follow-up 3 years) relative to placebo, whereas those receiving metformin had a 31% reduction relative to placebo (3).

The potential benefits of interventions to prevent diabetes are substantial, but so are the costs of implementing such programs. In the DPP, for example, estimated direct medical costs (inside and outside the program) over 3 years for the lifestyle intervention totaled ~$2,269 more per person than the corresponding costs for individuals receiving the placebo intervention. In addition, estimated per-person direct nonmedical costs and indirect costs for the lifestyle intervention were $1,271 higher than for the placebo intervention (5). Although some of the costs of the lifestyle intervention, such as routine medical care and prescription medications, might have been covered by medical insurance if the intervention had been provided outside of the trial, participants would have probably borne the costs for other intervention components, such as curriculum materials, exercise equipment, and transportation to and from counseling sessions. Two studies suggested that the DPP lifestyle intervention was relatively cost-effective from a societal perspective, both within the trial (6) and for the simulated lifetime of participants (7). However, these studies do not indicate how much patients would be willing to pay personally for this intervention.

Participants' willingness to pay (WTP) provides a measure of how much individuals value the benefits they would receive from a diabetes prevention program. This information would be very useful for managed care organizations or communities that are thinking about implementing a diabetes prevention program, such as the DPP. First, a higher WTP may indicate a higher participation rate if such a program were offered. Second, the WTP also indicates whether a sponsor organization can recover some or all of the intervention costs from program participants. If at-risk individuals are willing to pay a significant portion of the costs of an intervention, then it may be feasible for sponsors to implement interventions without experiencing large financial burdens.

The purpose of this study was to estimate how much individuals at risk for diabetes are willing to pay to participate in interventions to prevent diabetes. Individuals' WTP for the program was measured using a stated-choice conjoint survey administered to a high-risk sample

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R.M. was employed by RTI International at the time this study was conducted.

Full statistical results are available upon request.

Additional information for this article can be found in an online appendix at http://care.diabetesjournals.org.

Abbreviations: ADA, American Diabetes Association; DPP, Diabetes Prevention Program; WTP, willingness to pay.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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See accompanying editorial, p. 1447.

Table 1—*Attributes and levels of hypothetical diabetes risk-reduction programs*

Attribute	Attribute levels
Diet	No diet restrictions
	Flexible low-calorie diet
	Restricted diet
Exercise per week	No exercise
	3 h of exercise
	6 h of exercise
Counseling	No counseling
	8 sessions of counseling
	16 sessions of counseling
Medication	No medication
	Medication: a pill that can reduce the risk of developing diabetes with mild side effects
Weight loss goal in a year	No weight loss
	Lose 20 lb
	Lose 40 lb
Personal cost for 3 years	$25/month
	$50/month
	$100/month
	$200/month
Diabetes 3-year risk reduction	30% risk reduction in the next 3 years
	50% risk reduction in the next 3 years

composed of overweight and obese adults aged ≥45 years.

RESEARCH DESIGN AND METHODS

— A total of 703 respondents were drawn in 2004 from a Web-based panel maintained by Harris Interactive (8). We selected a purposive sample to ensure at least 600 respondents, including at least 400 obese and at least 200 nonobese individuals; the size of the sample was based on power calculations and our previous experience with stated-choice studies (9). In addition to screening respondents by age (≥45 years), we oversampled minorities so that they composed ~22% of the observations. We calculated a diabetes risk score for each individual that was based on the American Diabetes Association (ADA) Diabetes Risk Test (10). According to the ADA, a score of ≥10 indicates that an individual is at greater risk of having undiagnosed diabetes. For the present analysis, we excluded those individuals with risk scores <10 and those with BMI <24 (per DPP recruitment standards) to arrive at our final sample size of 582 individuals. Although other diabetes risk indicator scores exist (4,11), those scores require detailed physical and medical information that we could not collect from the Web survey respondents. In the final sample, 58% of respondents were male, mean age was 54.5 years, and mean BMI was 34.9 kg/m^2.

Self-assessed diabetes risk

Our survey first described general diabetes risk factors and diabetes-related complications. After reading these, respondents were asked to provide their self-assessed lifetime risk of developing diabetes and their risk of developing diabetes in the next 3 years. The survey questions focused on 3-year risk (12), which was elicited by presenting information on average risk and asking respondents to compare their risk to the average risk, which is detailed in the online appendix (available at http://care.diabetesjournals.org). We classified respondents as having high self-assessed risk or low self-assessed risk based on their response. Those in the "high self-assessed risk" category rated their 3-year risk of developing diabetes as "much higher" or "higher" than average. Those in the "low self-assessed risk" category rated their risk as "average," "lower," or "much lower." The high-risk and low-risk designations measure individual perceptions of risk. As noted above, all respondents had scored at least 10 on the ADA risk test; therefore, low-risk perceptions were not consistent with the objective risk as measured by that test.

Stated-choice survey

We designed a stated-choice survey to measure respondents' preferences for diabetes risk-reduction programs and the rate at which they were willing to accept trade-offs among program attributes, such as exercise levels, diet restrictions, and risk reductions. The stated-choice methodology is based on utility-theoretic principles (13) and has been tested and validated in numerous applications. Ryan and Farrar (14) reviewed the health applications of this methodology. Applications to chronic diseases include WTP for cholesterol-lowering medication and willingness to devote leisure time to a program that included medication, diet, and exercise (15); diabetic patients' WTP to reduce the risk of complications (16); and WTP for symptom relief of gastroesophageal reflux disease (17).

Our survey instrument elicited respondents' willingness to accept trade-offs among intervention attributes. It presented respondents with a series of nine choices between pairs of hypothetical risk-reduction programs and a no-participation alternative (see figure in online appendix). Each program consisted of seven program attributes. The no-participation alternative allowed respondents to select the status quo by choosing not to enroll in either of the two hypothetical diabetes prevention programs offered in each question. A set of program attributes defined each hypothetical program, including dietary restrictions, exercise requirements, number of counseling sessions, medication to reduce the risk of developing diabetes, weight loss goals, monthly out-of-pocket cost, and specified reduction in the risk of development of diabetes. Table 1 presents the attributes and their levels.

The levels of the attributes were systematically varied in each program alternative according to an experimental design with known statistical properties (18). Respondents chose between programs; the design allowed us to estimate the trade-offs between individual attributes by applying a model of stochastic utility maximization. The design ensures efficient statistical estimates of relative satisfaction weights based on the observed pattern of respondent choices among the program profiles presented. We presented information on the risk factors for diabetes and elicited information about health history, asking specifically about respondents' risk factors for developing diabetes. We also obtained information on respondents' experience with diet, physical activity, and weight loss.

WTP calculations

The stated-choice trade-off data were analyzed using conditional logit models as

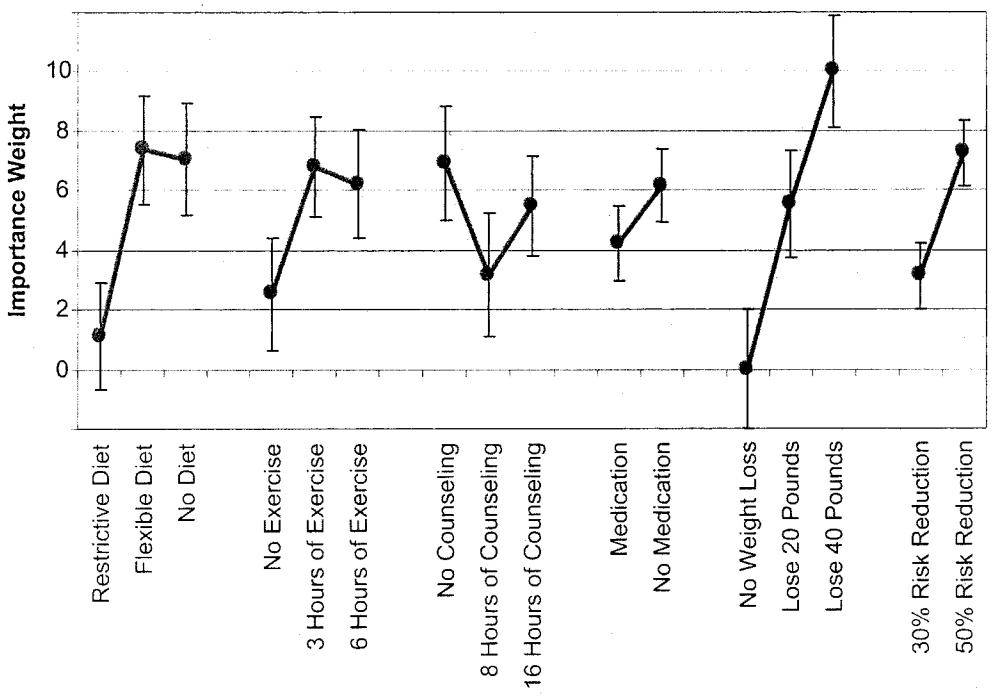

Figure 1—*Relative importance of program attributes. The most preferred attribute has a value of 10; the least preferred attribute has a value of 0.*

described in the online appendix. Results from the logit models were used to calculate respondents' WTP for individual program attributes as well as for entire programs. Separate models were estimated for the full sample and for the self-assessed low-risk and high-risk subgroups. Based on their high ADA risk scores, all individuals in the sample could be considered candidates for diabetes prevention. Because respondents with high self-assessed risk may be more likely to be interested in reducing their risk, we estimated whether this group had the highest WTP for interventions to reduce the risk of developing diabetes.

We evaluated individuals' WTP for different hypothetical diabetes risk-reduction interventions by specifying the attributes associated with the program and calculating the WTP associated with those attributes relative to the status quo. It should be noted that actual interventions that feature these attributes do not necessarily exist. Rather, the WTP estimates tell us how much individuals would be willing to pay for an intervention with the specified attributes, if such an intervention could be designed and implemented. We calculated the WTP for the program containing the most preferred attribute level in each attribute category, as determined analytically, and evaluated whether such a program is likely to be technologically feasible. To investigate respondents' preferences over clearly feasible diabetes prevention interventions, we created program profiles with characteristics similar to the actual DPP lifestyle and medication interventions (5).

Protection of human subjects

RTI's Institutional Review Board reviewed the study and determined it to be exempt.

RESULTS

Self-assessed risk

Although all of the respondents had an elevated risk for diabetes according to their ADA scores, only 27% (157/582) reported high self-assessed risk. Of those with high self-assessed risk, 54% said that they had ever been told by a doctor or health professional that they were at risk of developing diabetes, whereas 20% of those with low self-assessed risk reported that they had been told.

Preferences for program attributes

Figure 1 shows preference ratings for the attributes making up the programs in the stated-choice survey. The coefficient values were standardized so that the most highly preferred attribute level has a value of 10 and the least preferred attribute level has a value of 0.

Programs with weight loss goals were strongly preferred over programs with no weight loss goals. A weight loss goal of 40 lb was more preferred than any other attribute, and the "no weight loss" goal was the least preferred attribute. Although respondents indicated that weight loss goals were important, they preferred programs with either flexible diets or no diet restrictions to programs with restrictive diets. Programs with exercise requirements were preferred to programs with no exercise requirements; there were no significant differences between programs with 3 h and those with 6 h of exercise. Programs with no counseling or with 16 h of counseling appeared to be preferred to programs with 8 h, but the coefficients for these attributes were not significantly different. Programs with no medication were slightly preferred to programs with medication, but the difference in coefficients was not statistically significant. Not surprisingly, individuals preferred programs that offered larger risk reductions for diabetes.

Willingness to pay for lifestyle interventions

For the full sample, respondents were willing to pay ~$2,270 over 3 years to change from not participating in a program to participating in the program that had the most preferred attributes in each category (Table 2). This amounts to roughly $63 per month for 36 months. Although this is the program that individ-

Table 2—*WTP for selected interventions*

	Most attractive	High goals, high commitment	Similar to DPP lifestyle	Similar to DPP medication
Features				
Diet	Flexible	Restrictive	Flexible	No diet restrictions
Exercise (hours/week)	3	6	3	3
Counseling (h)	0	16	16	0
Medication	No medication	Medication	No medication	Medication
Weight loss goal (lb)	40	40	20	No goal
Risk reduction (%)	50	50	50	30
Estimated % probability that representative individual will choose intervention over status quo when intervention is free				
Full sample	66.9	57.3	61.5	51.3
Perceived high risk	81.2	74.7	74.3	68.9
Perceived low risk	65.1	50.8	58.0	44.5
WTP over 3 years*				
Full sample	$2,270 ($1,840–3,050)	$950 ($180–1,620)	$1,510 ($820–2,170)	$170 ($0–840)
Perceived high risk	$4,400 ($3,940–5,740)	$3,240 ($2,160–4,190)	$3,190 ($2,110–4,270)	$2,380 ($1,340–3,360)
Perceived low risk	$2,000 ($1,230–2,910)	$100 ($0–980)	$1,030 ($150–1,850)	$0 ($0–150)

*Data are mean WTP with estimates rounded to nearest $10 (95% CI).

uals would most like to buy, it features both high benefits (weight loss goal and risk reduction) and relatively little sacrifice from respondents in the form of diet, exercise, counseling, or medication. Such a program is unlikely to be achievable technologically. To participate in a program that combined the same weight loss and risk-reduction benefits as the most preferred program but required more commitment (a stricter diet, more exercise, more counseling, and medication), respondents were willing to pay ~$950 over 3 years, or ~$26 per month.

Looking at the full sample results for programs representing the DPP, individuals were willing to pay $1,510 over 3 years (~$42 per month) to participate in a lifestyle intervention program similar to that of the DPP. For the medication intervention, there was only about a 50% probability that individuals would choose the medication intervention over the status quo if the intervention were free. Respondents would be willing to pay $170 over 3 years (<$5 per month) for a program similar to the DPP medication intervention.

We also estimated WTP separately for individuals with high and low self-assessed risk. Individuals with high self-assessed risk would be highly likely to choose an intervention over the status quo if the intervention was free; in contrast, individuals with low self-assessed risk would sometimes be more likely to choose the status quo. For each intervention program, individuals with high self-assessed risk were willing to pay substantially more than individuals with low self-assessed risk.

CONCLUSIONS — In our study, we attempted to quantify how much individuals at high risk are willing to pay for diabetes risk-reduction programs. In interpreting the WTP results, it is important to emphasize that our analysis considers only preferences. It does not tell us how actual combinations of attributes contribute to actual program outcomes such as weight loss and diabetes risk reduction. That is, the stated-choice survey provides information on the demand and WTP for diabetes prevention programs, but it does not provide information on the supply or technological feasibility of programs. For example, we found that individuals had the highest WTP for a program with high benefits and few sacrifices. The WTP for the most preferred program places an upper limit on the amount that individuals are willing to pay for any diabetes prevention program. However, with current technology, the most preferred program cannot be supplied. The WTP for a more realistic, but hypothetical, program, one providing large benefits but requiring large sacrifices, was $950 for 3 years, or ~$26 per month.

We estimated the WTP for two intervention programs whose attributes roughly matched the lifestyle and medication interventions that were supplied in the DPP. The full sample results show that the average WTP for a lifestyle intervention similar to the DPP was ~$1,510 or ~$42 per month. By comparison, the estimated out-of-pocket cost for the DPP lifestyle intervention was roughly $65 per month. Thus, most of the individuals in our study were not willing to pay the out-of-pocket cost of the DPP lifestyle intervention. To induce individuals to participate, the intervention would have to be partially subsidized by the intervention sponsor, an insurer, or another private or public source. The WTP for the lifestyle intervention was considerably higher than the WTP for the medication intervention. The 20-lb weight loss goal for the lifestyle intervention accounted for the biggest difference in the WTP estimates for the two DPP-like interventions.

We found that WTP was closely related to individuals' self-assessed risk of developing diabetes. Nearly 40% of respondents with low self-assessed risk never selected a risk-reduction program. These individuals preferred their status quo over incurring the costs to participate in a risk-reduction program. Respondents in the high self-assessed risk group were

much more likely to prefer one or more of the risk-reduction programs over the status quo. Individuals in this group were willing to pay $89 per month for a lifestyle intervention program similar to the DPP lifestyle intervention and $66 per month for a medication intervention similar to the DPP medication intervention. Individuals with low self-assessed risk had much lower WTP.

Our study has potential limitations. We collected information by surveying members of an Internet web panel. Web surveys provide a quick and economical way of surveying participants with particular characteristics, such as individuals at risk of developing diabetes, and they allow participants to answer a series of choice questions that would be difficult to include in other types of surveys. Nevertheless, the results may be affected by possible selection biases related to Internet access and other factors that influence membership in the panel. The sociodemographic characteristics of members of the overall web panel are reasonably close to characteristics of the overall U.S. population (8), but the demographic statistics for any particular survey depend on the survey's sampling frame and which members answer the survey. We purposely oversampled minorities and obese individuals because of their increased risk for diabetes. Almost all respondents in our study had a high school education, and respondents reported an average income higher than the national average. In our analysis, self-assessed risk was not significantly affected by education or income; it was positively and significantly affected by family history of diabetes. Education, income, and family history had positive and significant effects on estimated WTP. The complexity of our experimental design precluded us from applying sample weights to the WTP estimates.

The ability to derive the relative importance of component features of interventions is an advantage of stated-choice methods. Multiattribute trade-off data facilitate evaluating preferences for interventions with features that are not currently available. However, testing how closely intended behavior translates into actual behavior would require data on actual choices made by patients with diabetes. Some studies have observed discrepancies between stated preferences and subsequent observed behavior (19–21). Nevertheless, Henscher et al. (22) found that stated-choice data provide accurate measures of the relative importance of features, even when predicted uptake is biased.

With these potential limitations in mind, our results may be useful for policy makers deciding whether to offer risk-reduction programs for individuals at high risk of developing diabetes. Previous research on the DPP and other interventions indicates that they are efficacious and cost-effective (1–4,6,7). At the same time, such programs have fairly high costs. Policy makers may be reluctant to offer these programs unless participants are willing to pay some or all of the costs of the interventions. Our WTP estimates suggest that individuals will be willing to participate in interventions to delay or prevent diabetes if they are partially subsidized, but most will be unwilling to pay the full cost of the program.

Our results also offer insights for designing risk-reduction programs that appeal to potential participants. Respondents especially preferred programs that featured large weight loss goals, few restrictions on diet, and larger reductions in the risk of diabetes. Including these attributes in a program may increase potential participants' WTP. By comparison, variation in exercise levels, counseling levels, and the use or nonuse of medications had relatively little effect on program choice or WTP. Therefore, adding slightly higher weight loss goals to a program while increasing the program's exercise level may increase individuals' WTP for the program.

Our finding that WTP was closely related to individuals' self-assessed risk of developing diabetes suggests that better patient information could increase WTP. Even though all of the individuals in the sample were at high risk for developing diabetes, many reported that they had not been told by their physician that they were at risk. Better risk communication by physicians and better overall patient education about the risks of diabetes should produce more accurate and higher self-assessments of risks by individuals. In turn, higher self-assessments may lead to greater WTP for diabetes risk reduction.

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